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Procedia - Social and Behavioral Sciences 47 (2012) 1469 – 1472

Procedia
Social and Behavioral Sciences

CY-ICER-2012

# New educational research technologies in the global world

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**Abstract**

This paper provides a review of major elements of stress and coping with a specific focus on physiological influences of stress on learners in educational settings. A general overview of stress and coping, including General Adaptation Syndrome and its different stages, good and bad stress (eustress and distress) will be discussed. In addition, the importance and application of new technologies, in educational research, to measure physiological changes during stress will be reviewed. To measure physiological major bodily changes during stress (e.g. anxiety) in educational settings, different instruments such as EEG (electroencephalography), ECG (electro cardio- graphy), EOG (electro-oculography), GSR (Galvanic Skin Response), and tachistoscope are introduced for conducting educational research and assessing stress in teaching and learning environments. These technologies provide information about involved systems of the brain, heart, eye, skin, visual perception and attention, respectively. The importance of the paper is that educational researchers can combine their educational research methodologies (qualitative, quantitative and mixed) with application of these technologies to get a better understanding of the impacts of stress on physiological bodily changes of learners in educational contexts.

*Keywords: stress; education; educational research*

## 1. Introduction

Stress as a mental or physical phenomenon is "the nonspecific (that is, common) result of *any* demand upon the body for survival and accomplishment of our aims" (Selye, 1980, p. vii, cited in Bigdeli and Bai, 2009). There is a significant difference between good stress (*eustress)* and bad stress (*distress*)(Selye, 1980 cited in Bigdeli and Bai 2009), from which mostly, people suffer and complain. Distress significantly influences cognitive processes (Eysenck, 1979), learning (Bourne, 1986; Eysenck (1979); Hertel & Hardin, 1990; Rathus, 1990), information processing, and memory (Hedl, 1986; Ellis, 1990; Hertel & Hardin, 1990).

Distress inducing factors are prevalent in the global world. In this world, people face new and different life styles, adopt new roles that are often disassociated from or unrelated to their previous roles some of which are highly challenging. In this section, I will discuss distress and General Adaptation Syndrome.

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 doi:10.1016/j.sbspro.2012.06.844

## 2. Origins of the Word Distress

Origins of the word distress goes back to Middle English *destresse,* from Anglo-French *destresce,* from Vulgar Latin *districtia,* from Latin *districtus, and* first used from 13th century, for which affliction, agony, anguish, excruciation, hurt, misery, pain, torment, torture, and affliction (Webster online dictionary, 2011) are mentioned, all of which imply a state of uneasiness and being under a great pressure due to physical or mental distress .

In this regard, Hans Selye proposed the General Adaptation Syndrome (GAS) or Biologic Stress Syndrome, and emphasized stress management coping mechanisms that lead to optimal health, happiness, and prolonged life. He argues that stress creates imbalance in the body and the body response to this imbalance is resistance or tolerance. The involuntary biochemical responses during stress are identical to regulating voluntary interpersonal behavior. According to the GAS, prolonged exposure to stress leads to psychological and physical damage. In GAS, due to a new situation, there is a reaction of surprise and stress (Alarm), which follows by fight or flight reaction. A stressor disrupts body homeostasis and adrenal cathecolamine secretion happens. Then, body tries to eliminate the stressor or learns to cope with the stressor and changes in homeostasis efficiently (Resistance). Finally, resistance fails, depletion of energy reserves decreases sleep and rest, fatigue or even death may occur (Exhaustion) (Selye, 1974; Hubbard & Workman, 1998).

## 3. Measures of Distress

Stress with its psychic (mind, soul), somatic (physic, physiology) and behavioral components, negatively affects cognitive processes and learning (Bigdeli and Bai, 2009) and positions learners in an extremely challenging situation that brings about a sense of unsafety and insecurity. To understand its nature, it is required to study stress theoretically and practically in teaching and learning contexts. In this regard, making a bridge between medical sciences and educational research can enhance the results.

Distress can be measured through: 1) subjective self-report 2) objective observation 3) perceptions and evaluations of conditions that arouse emotional response, and 4) physiological measures of distress (Bigdeli and Campbell, 2007). Given that affective and cognitive factors are deeply interrelated and they have deep connections to physiology, it seems appropriate to contrast and conjoin medical technologies to measure physiological manifestations of stress in educational studies. Some of these instruments widely used in medical sciences are as follows.

### *3.1.Electroencephalography (EEG)*

It measures fluctuating voltage potentials on the scalp generated in large part from electrophysiological activity within the brain. Neurons within the cerebral cortex continuously generate electrical activity that can be recorded as electroencephalograms. An EEG can be taken as the collective expression of millions of action potentials from neurons (Van de Graaff, Fox, &Lafleur, 1997), which provides information about the electrical fluctuations between neurons and characterize the overall activity of the brain (Silverthorn, 2004). In a state of arousal, brain waves are of higher frequency and less synchronised, whereas in relaxation states brain waves are more synchronised (Claxton, 1999). According to Marieb(2001) and Ziada(2000), in the state of arousal, brain waves could be grouped in 4 classes of frequency[†]: 1) Delta waves (4Hz or lower) occur in infancy and during deep sleep in both children and adults, and when reticular activating system is diminished for example in anaesthesia, 2) Theta waves (4-7Hz), common in normal children or adults under emotional stress, 3) Alpha waves (8-13Hz), indicating a calm, relaxed state of wakefulness, and 4) Beta waves (14-25 Hz or 18-30 Hz) occur when we are mentally awake and alert, or during intense activation of the central nervous system or tension (Marieb, 2001; Ziada, 2000).

### *3.2.Electrocardiography (ECG or EKG)*

It is the recording of the electrical voltage in the heart. ECG shows the sum of the electrical potentials generated by all the heart cells at any moment. The electrical events of the ECG can be associated approximately to contraction and relaxation of the atria or ventricles. Heart waves are grouped as: P wave (depolarization of the atria), QRS complex (progressive wave of ventricular depolarization), and T wave (repolarization of the ventricles) (Bigdeli and Campbell, 2007, Marieb, 2001; Silverthorn, 2004; Van de Graaff, Fox, & Lafleur, 1997).

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[†] Brain waves recorded from EEG are measured in units of cycles per second, or Hertz, abbreviated as Hz.

*3.3. Electro-oculography (EOG)*

It is a method used to record the electrical charge difference between the front and back of the eye (Webster online dictionary, 2011) correlated with eye movements (Rohner, 2004; Webster online dictionary, 2011).

*3.4. Galvanic Skin Response (GSR)*

Galvanic Skin Response or electrodermal response (EDR) measurements show the activity of the eccrine sweat glands, with the concentration of these glands being the highest at the fingertips. This psychogalvanic reflex is based on the fact that emotional states lead to reflex increase in sweating. Stress increases sweat gland activity, the skin moisture, and skin conductance (Elkadi, 1984; Luria, 1987; Pecchinenda and Smith, 1996).

*3.5.Tachistoscope*

It is an apparatus for the brief exposure of visual stimuli that is used in the study of learning, attention, and perception (Webster online dictionary, 2011) and is of value in psycho-educational studies (Bigdeli, 1995).

## 4. Conclusion

In the global world, nature of educational research necessitates application of non-invasive research methodologies to assess stress and coping and to run research related to these fields. Extending medical technology into educational research to assess physiological manifestations of stress and coping is appropriate and warranted. I briefly reported some of these technologies that have substantial importance in educational research. These tools have strengths and weaknesses, however, application of these tools and their associated research methodologies to answer educational research questions are encouraged.

In addition, to provide an acceptable continuum for educational research, to consider stress in teacher education programs, and to revise curriculum of the field by inclusion of physiology courses related to stress and its measures, to help teachers get a better understanding of the phenomenon is required. The importance and relevance of taking psychophysiological technologies into educational settings is that application of these technologies provide an integrative approach to collect, analyze, and interpret data in educational research. Moreover, teachers, well equipped with new technologies, can apply them in their educational research contexts and fortify their findings. In this regard, inclusion of Educational Neuroscience as a new field of study(Campbell, 2011, Bigdeli and Campbell, 2007; Campbell, Bigdeli, Handscomb, etal, 2007) to teacher education curriculum, by bridging cognitive neuroscience and educational psychology which tries to employ new advances of medical technologies in educational research settings, can fill the existing gap.

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